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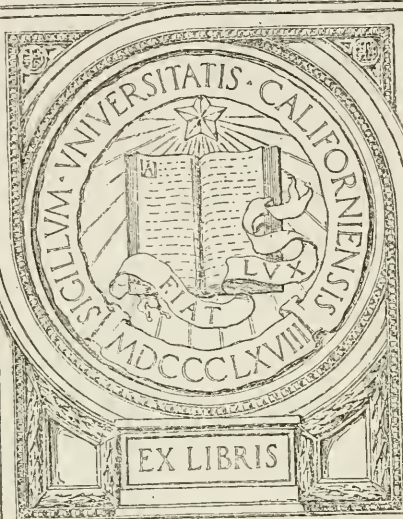
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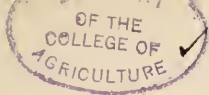
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EPITHELIOSIS INFECTIOSA AVIUM

OSCAR VICTOR BRUMLEY

JAMES HOWARD SNOOK

College of Veterinary Medicine

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EPITHELIOSIS INFECTIOSA AVIUM

CONTAGIOUS EPITHELIOMA, CHICKEN POX, DIPHThERIA, ROUP, CANKER

In the fall of 1910 our attention was called to this disease owing to the number of birds that were presented for treatment at the hospital. A large Rhode Island Red cockerel, which the owner prized very highly, was brought in one day with the request that everything possible be done to restore it to normal condition. On examination the bird was found to have a marked nasal discharge affecting both nostrils, croupous-diphtheritic membranes in the oral cavity, particularly involving the tongue, the throat, and at the commissures of the mouth. The general condition of the patient was much disturbed; depression, rough plumage, loss of appetite, some elevation of temperature, etc. An autogenic vaccine was made from cultures taken from the lesions and used as a curative agent, our experience with other methods of treatment having proven very unsatisfactory. Cultures were taken from beneath the deposits and agar slopes inoculated. The cultures were allowed to grow (about 36 hours) until a heavy growth appeared on the surface of the agar and a vaccine made up in the regular manner, standardized to a No. 7 nephelometer tube, and attenuated by heating to 55 deg. C. for one hour. One cubic centimeter of this vaccine was injected subcutaneously. Marked improvement was noticeable. Another injection of the same amount was made in four days. At this time the croupous membranes were beginning to disappear and the nasal discharge was less copious and the general condition much improved. Complete recovery took place without further incident. The results of this treatment were so satisfactory that this method was tried on other roup patients in the hospital. The results were uniformly good. As a result of these experiences a series of experiments were begun, with the object of studying the etiology of the disease and the value of the vaccine as a prophylactic and curative agent.

Name of the Disease

This disease, owing to the variety of names which have been given it, has been much confused by a number of writers. Our experiments and experience with the disease prove quite conclusively that the so-called roup, chicken pox, diphtheria, canker are one and the same disease. Other investigators (Carnwath) succeeded in producing diphtheritic or croupous membranes in the mouth by pure pox material and pox lesions from the material taken from the diphtheritic or croupous membranes. These results have been substantiated by Schmid, Uhlenhuth, Manteufel and Ratz.

Both forms of the disease are very frequently observed in the same flock of birds. During the warm months of the year or in warm climates, the prevailing form is the pox lesions on the comb and wattles, while in the cold months or in a northern climate, the croupous or diphtheritic form predominates. Cohabitation of birds shows that a pox-infected bird introduced into a flock will produce either the croupous or diphtheritic form, or chicken pox; or vice versa, a fowl affected with the croupous or diphtheritic form will transmit the regular chicken pox. As experiment has shown the various types of the disease are but manifestations of a single clinical entity, and therefore the disease should be designated by one name. The name proposed by the writers is "Infectious Epitheliosis of Birds."

Prevalency and Distribution of the Disease.

The disease is found affecting nearly all birds, especially chickens, turkeys, peafowls, pheasants, guineas, pigeons, sparrows, quail, etc. It is not so frequently observed in ducks, geese and swans. The disease is widely distributed, appearing in practically all countries where birds are found in any considerable numbers. In the United States the disease is quite general, but more prevalent in the northern states, especially during the colder months. In the fall when the cold, damp weather begins outbreaks occur quite generally, and poultrymen often refer to the early inception of the disease as a cold. The intensity of the disease usually increases until the warm weather makes its appearance, when it diminishes and lies dormant, to reappear at the first cool, damp weather in the fall when the birds are more closely confined.

Etiology

Evidence obtained by our experiments indicates that a filtrable virus is the primary causative agent, and that more or less severe complicating conditions are induced by secondary infection, of which a bacillus, probably the bacillus diphtheriae columbarum of Loeffler seems to be the most important.

Pathogenesis

Transmission of this disease is not very difficult. Usually about 70% of healthy birds will show symptoms of the disease after associating with an affected one for a short time. Actual contact is not necessary, as is shown by the spread of the disease at poultry shows. When using an infecting bird with mucous membrane lesions, a few of our experimental birds would show cutaneous lesions, and if a bird with the cutaneous form was used the mucous membrane lesions were in excess.

Emulsions of scrapings from either cutaneous or mucous membrane lesions injected subcutaneously, submucously or applied to scarified areas on the skin, would in some cases produce the generalized form of the disease. Similar results were produced by using an emulsion of a 24-hour agar growth of cultures taken from lesions and injected subcutaneously.

It is possible at times by scarifying the mucous membrane of apparently healthy birds to produce at the point of injury local lesions not unlike those of this disease, but they disappear in a few days without manifestation of general symptoms. Incomplete experiments by using the blood of sick birds in an attempt to produce the disease gave negative results, which is contrary to that claimed by a few other investigators.

Natural Infection

There are a variety of ways by which natural infection takes place. Cohabitation is one of the most common methods, an infected bird introducing the disease into an entire flock. The exfoliated membranes, or the exudate given off while sneezing or coughing, act as intermediary carriers to the healthy birds. The infection in this way will find lodgment on the skin where there are slight abrasions, or on the mucosa of the eyes or mouth, where it develops either to form the pox lesions or the various other forms found on the mucous membranes.

It is quite possible to have the disease develop in the eyes by the infection gaining entrance, and the bird irritating the membranes by rubbing them against objects or by scratching them with their feet.

The disease is frequently spread by food or drink which is contaminated with infective material.

A very common source of the disease is the poultry show where infected birds are exhibited, and conditions exist favorable to reduce the bird's resistance. It very frequently happens that on the return of birds from the show the disease develops in the course of a week or ten days. Sparrows and pigeons are common carriers often transporting the infection great distances. This is a very important method of transmission often overlooked. The disease has been observed in sparrows in a number of cases and exhibiting in them the same characteristics as in other birds. Sparrows and pigeons come in direct contact with poultry at feeding time and thus infect them. It is sometimes spread by such intermediary agents as infected coops, clothing, etc. Young birds are more susceptible to the infection than older ones. Pigeons and chickens seem to be far more susceptible than other birds.

It has been observed that one attack of the disease will produce immunity for a certain period. Either the skin form or involvement of the mucous membranes confers equal immunity against the opposite form.

Pathology

The post-mortem findings vary with the immediate cause of death. In rare cases when death is due to suffocation early in the disease only the acute conditions are noted. The body appears fairly well nourished, the mucous membranes are covered with a thick slimy mucous which may occlude the upper air passages. In the larynx, or somewhere along the trachea, possibly in the larger bronchi, will be found the mass of dense, tough, yellowish material obstructing the lumen.

In some cases when both eyes are involved death results from starvation early in the disease. The body is emaciated. The mucous membrane of the eyes, and often of the mouth and respiratory passages show inflammation, and usually there is a mass of this same yellow material in the conjunctival sac distorting or obscuring the eyes. The skin around the eyelids may also be involved.

The majority of the fatal cases die in two to five weeks. In these cases the body shows all the symptoms of a toxemia, emaciation is pronounced and the serous membranes show petechiae. In the cutaneous form the skin presents all the symptoms of a severe inflammation, each nodule being a distinct process. Some of them show a similarity to tumor formation, especially on the comb where the skin is thickest, but on the wattles and feathered skin around the head this feature is less pronounced. Masses of tough yellow material often distend the suborbital fossae, accumulate in the external ear, in the lung substance, and along the digestive tract.

Symptoms

The disease assumes various forms, depending upon whether it involves the mucous membranes of the mouth, the nasal passages, the eyes, the intestinal tract, or the skin. It is necessary from a clinical standpoint to consider these various types of the disease. It is this fact which has led to so much confusion among the poultrymen, as they have been inclined to consider these forms separate diseases.

In previous articles which have been published in the various poultry journals by the writers, we have tried to make clear the fact that the varied clinical manifestations are merely forms of one disease. A number of progressive poultrymen are beginning to realize this, as they frequently observe all the different forms at the same time in the same flock.

Nasal Passages. The early symptoms are similar to those of an acute nasal catarrh, but the bird shows more dullness and prostration and there is present a peculiar offensive odor (the odor in this disease is very characteristic). The discharge from the nasal passages is at first thin, serous, and later becomes thicker and glutinous, causing the affected birds to sneeze and shake their heads in an effort to clear the nasal passages. The secretions from the nasal passages collect around the openings forming dirty, yellowish crusts.

The infraorbital fossae become inflamed and distended with pus, forming an enlargement on one or both sides of the head below the eyes. Owing to the occlusion of the nasal passages the bird breathes with open mouth.

The Eyes. At first a thin serous secretion is observed flowing from one or both eyes; later it becomes turbid, thicker, adheres to the edges of the eyelids and dries to form crusts com-

completely closing the eye. The retained yellow material becomes thicker and often accumulates to such an extent that it causes a pronounced bulging of the eyelids. Masses of this material as large as a walnut are often removed from beneath the lids. Sometimes infection develops posteriorly to the eyes in the form of abscesses which force the eyes partly out of their position. The cornea is turbid and often ulcerated. Complete destruction of one or both eyes is often observed in severe cases.

The Mouth. Involvement of the mucous membrane of the mouth begins as a local disturbance. The disease begins by a slight redness or congestion of isolated areas, or may involve the entire surface. In the center of the congested areas there will appear in a day or so, small round or oval yellowish white spots, which rapidly spread and eventually form extensive collections of glutinous pus, having somewhat the appearance of diphtheritic membranes. The nature of the collected material on these areas led to the name "diphtheria" for this form. As the disease progresses this process often extends over the entire mucosa of the mouth, tongue and throat. When extending into the larynx, and even into the trachea as it does occasionally, there will be marked symptoms of dyspnea. Asphyxia is frequent when the lesions extend to the larynx and trachea. On removal of the deposits the mucosa presents a red, granulating surface, which bleeds easily, showing in some cases extensive submucous swelling and edema. The commissures of the mouth are frequently involved, and in some cases spreads to the skin and contiguous tissues, producing a characteristic pox lesion on the skin. Other complications are frequently found spreading from the oral cavity, i. e., to the pharynx, esophagus and crop, producing severe diarrhea and other bowel disturbances.

The Skin. Lesions on the skin are found in quite a few cases, more commonly on the comb, wattles and other portions of the skin not well protected by feathers. It is first noticed as a very fine gray vesicle, which soon develops into small elevations of a reddish gray color, which later become more grayish yellow. Microscopically the nodules are composed of degenerated epithelial cells. These nodules in some cases become quite large, warty in appearance, dry and hard. In severe cases large number of these nodules are found distributed over the skin on exposed surfaces. On removing the surface of the nodules a raw granulating area is noted. Some cases show distinct degeneration of contiguous tissues.

A mixed variety of the disease is of frequent occurrence, the mucosa showing the characteristic deposits and the skin pox lesions. It is quite evident in these cases that the disease spreads from one location to the other, and the difference in the lesions is due to the difference in the structure of the tissue involved.

General Symptoms. In the early stages before much secondary infection takes place, there are no marked general symptoms. Later marked general symptoms appear. The birds show dullness, assume a sitting posture, wings are held pendant, plumage becomes rough and the patients show much depression. The comb and wattles grow bluish red in color, later pale and cold. In the colder climates the disease often assumes a subacute or chronic form. While in warmer climates the acute form is more often observed. Frequently, however, the disease assumes the character of a chronic catarrh.

Diagnosis

The disease usually makes its first appearance in the fall of the year and often occurs as the cutaneous form; it may be overlooked, especially if the birds are on the range. The mucous membrane form usually makes its appearance soon after housing for the winter. The sneezing, mouth breathing, occluded nostrils, and an occasional inflamed eye, are significant especially when rapidly spreading through the flock. Soon after, a few will refuse food and appear depressed.

It must also be suspected when similar symptoms appear after adding new birds to a healthy flock or returned birds from shows.

A peculiar characteristic and offensive odor is associated with this disease and poultrymen familiar with it often recognize the disease from the odor alone. The same odor is given off by cultures.

Differential Diagnosis

Wounds on the skin around the head, usually pick inflicted, appear suspicious, but these heal rapidly without extensive thickening. An injury to the eye, even though serious, will not cause the formation of the characteristic yellow deposit. Difficult respiration, rarely seen in more than one bird in a flock,

may be due to several causes, and those observed persisted for some time without affecting the general health of the bird.

Prognosis

The cutaneous form usually runs a more favorable course, apparently recovering in one to three weeks, when the nodules become dry and scale off. The mucous membrane form is less favorable, the mortality varying from 10 to 50%, depending on the care and sanitary surroundings.

Aside from the actual number that die we find there is considerable loss resulting from the chronic effects. After the disappearance of all visible lesions the birds do not seem to regain their former good condition for months. Egg production is far below normal, and young birds have their growth checked.

Treatment

There have been a great many drugs recommended in the treatment of this disease, and so far none of them have proven very satisfactory. Daily treatment of individual birds is a tedious and laborious task, especially where large flocks are affected.

The lesions, whether on the skin or in the mouth, should be washed with antiseptics, 2% boric acid solution, $\frac{1}{4}$ -1% potassium permanganate, or any other equally efficient antiseptic. The deposits should be removed with a curette or dull knife before applying the antiseptic.

Vaccination, which has proven very satisfactory, is done in the following manner: A vaccine is prepared by using a bacillus, probably the bacillus diphtheriae columbarum, which seems to be the most important, in conjunction with the other secondary organisms present. This is standardized to a No. 7 nephelometer tube, and 1 cc. of vaccine injected under the skin. In some cases a second injection is necessary in 4-6 days.

Prophylactic Treatment

All newly acquired birds should be examined and isolated for at least ten days before allowing them to come in contact with the regular flock.

As soon as the disease is recognized, it is to be recommended that all birds be vaccinated immediately to check it.

Healthy flocks and those intended for exhibition purposes may be vaccinated to establish immunity. This has proven very satisfactory as the appended report will show. The immunity established will last for at least one year.

Bacteriological Experiments

A bacteriological study of epitheliosis of birds was made under the direction of the writers by Dr. Israel Wallman.

The experiments consisted in the following:

1. Collecting cultures from the different lesions in each case, and isolating the organisms which were cultivated in pure cultures to study their cultural characteristics and pathogenicity.
2. Experiments with the blood to determine its virulency.
3. Experiments with the filtrate from an emulsion of scrapings from mucous membrane and cutaneous lesions.
4. A study of the pathogenicity of each of the different organisms alone, combined, and in connection with the filtrate.
5. Experiments in transmitting the disease by direct inoculations from the lesions.

Seventy-four cases of various forms of the disease were used in these experiments. Of these 54 showed lesions on the mucous membrane only, 8 cutaneous lesions, and 12 had both forms. Normal birds were used as controls.

Experiment No. 1

The following organisms were found fairly constant in sick birds, while in healthy birds the same organisms were constant with the exception of No. 1 described below.

Organism No. 1. (Probably the bacillus diphtheriae columbarum of Loeffler). A short, thick, highly motile bacillus taking a bipolar stain. Gram negative.

Broth: slight deposit and scum.

Dextrose-broth: acid, no gas production.

Sucrose: same.

Lactose: no acid, no gas production.

Milk digested without acid production, gelatin and blood serum digested.

Does not produce indol nor reduce nitrates.

On agar abundant growth, edge leaf-like.

Agglutination.

Normal blood serum agglutinates it in dilutions of 1-5. Serum from sick birds agglutinates it completely in dilutions of 1-20 and partially in dilutions of 1-60.

Complement fixation test.

Using an extract of this organism as an antigen did not produce fixation of the complement.

Antigen was prepared as follows: Organism was grown on agar and emulsion made in .85% NaCl solution heated for one hour at 60° C. and shaken for 36 hours at 480 strokes per minute. A 1-20 dilution of the extract of the organism did not prevent hemolysis. A 1-40 dilution of the antigen and positive serum in amounts varying from .03 cc. to .5 cc. was used for the test.

Pathogenicity: Healthy young chickens were inoculated as follows:

- (1) Two inoculated subcutaneously on the comb.
- (2) Two inoculated submucously in the oral cavity.
- (3) Two inoculated intravenously.
- (4) Two inoculated intraperitoneally.
- (5) Two inoculated by scarifying the wattles.

In birds Nos. 2 and 5, local lesions appeared on the second day, lasting an average of five days, and resulting in complete recovery without producing the typical diseases, i. e., there were no general symptoms.

Organism No. 2. A small motile bacillus resembling a diplococcus.

Stains by all ordinary stains, gram negative.

Broth: grows in small chains.

Agar: moist, transparent grayish growth.

Blood serum: not digested.

Gelatin: liquifies slightly.

Potatoes: grayish growth.

Milk: coagulates with acid production.

Sucrose-broth: acid and gas production.

Dextrose-broth: acid and no gas.

Lactose: acid (slight) and no gas.

Negative results on agglutination and complement fixation test.

Pathogenicity: A test made as with Organism No. 1 resulting in slight swelling at point of injection in mucous membrane and skin lasting for a few days without producing the disease.

Organism No. 3. A small non-motile cocco-bacillus.

Gram positive.

Gelatin and blood serum: not digested.

No action on normal or litmus milk.

Dextrose and sucrose broth: acid and no gas.

Lactose: no change.

Does not produce agglutination or complement fixation.

Pathogenicity: Does not produce the disease.

Organism No. 4. A large motile square-ended bacillus resembling *B. agiles*. Gram negative.

Broth: membranous scum.

Gelatin: arborescent growth and digestion.

Agar: abundant, spreading moist growth.

Milk: coagulated and digested with slight acid production.

Blood serum: not digested.

Sugar-broth: no change.

Pathogenicity: produces lesions but no general symptoms.

Organism No. 5. *Pseudomonas pyocyanea*.

Pathogenicity: Swelling and inflammation at point of injection. Intravenous injection resulted in septicemia recovering the organism from heart, kidneys, etc.

Organism No. 6. A small slender, highly motile bacillus.

Gram negative.

Produces a brick-red growth on agar, potato, gelatin and blood serum.

No coagulation or acid in milk.

No change in sugar broth.

Not pathogenic.

Organism No. 7. A small non-motile cocco-bacillus.

Gram negative.

Gelatin and blood serum: not digested.

Milk: no acid or coagulation.

Sugar-broth: no change.

Does not form indol nor reduce nitrates.

No special characteristics as to cultural growth and pathogenicity.

Organism No. 8. *B. necrophorus*.

Organism No. 9. A colon-like organism. Gram negative. Gelatin and blood serum: not digested.

Milk: coagulated.

Acid in litmus milk.

Lactose broth: acid and gas.

Sucrose-broth: acid and gas.

Dextrose broth: acid and no gas.

No indol. Nitrates were reduced to nitrites and ammonia.

Organism No. 10. *Staphylococcus albus*.

Organism No. 11. *Staphylococcus aureus*.

Organism No. 12. *Micrococcus citreus*.

Organism No. 13. *Sarcina tetragina*.

From the description of the pathogenicity of the different organisms it is seen that none were capable of producing the typical disease symptoms. On injecting an emulsion of all the different organisms more extensive lesions were produced.

Experiment No. 2

- a. The blood of a series of sick birds was examined by means of a dark-field illuminating apparatus and no organism was noted.
 - b. Inoculations from the heart, blood and liver substance showed no growth.
 - c. A series of birds were injected subcutaneously, submucously, intravenously and the wattles scarified with amounts varying from .2 to 1 cc. of blood serum from sick birds.
- The disease was not produced.

Experiment No. 3

Four birds with all the clinical symptoms of the disease were killed and an emulsion of the heads of these birds, passed through a Berkefeld filter, were used for this experiment. Each head was macerated and triturated separately with sterile sand and sterile physiological salt solution. The emulsion of each head was separately filtered through a Berkefeld filter. The filtrates were tested out on culture media and no growth was

present. Six birds were inoculated with each filtrate. Two of them subcutaneously, two submucously and two intraperitoneally. Four birds were used for the four different filtrates. Daily records were taken as to the temperatures, appetite and other clinical symptoms. The birds remained normal until the 12th day and from the 12th to the 20th day all of them became sick. All showed an elevation of temperature of two degrees or more, dullness and loss of appetite. Eleven had nasal discharge, eye lesions and saliva of a thick consistency. Seven had yellow caseous deposits in the mouth. Of these, three died in a few days and inoculations on media from the heart and liver showed no growth. Six birds showed general symptoms of roup but no local lesions.

Experiment No. 4

To determine the action of organisms on the remaining six birds whose resistance had been reduced by the filtrate injection. These birds were injected as follows:

- One submucously with organism No. 1.
- One submucously with organism No. 2.
- One submucously with organism No. 3.
- One submucously with staphylococci albi.
- Two submucously with a mixture of the four organisms mentioned.

In all cases typical lesions of the disease appeared at the point of injection.

Experiment No. 5

Experiment to transmit the disease by inoculating the mouth deposits of sick birds into healthy ones.

Six birds were inoculated submucously with scrapings from these lesions and on the third day pustules appeared at the point of injection. On the fifth day a yellowish membrane appeared. Lesions disappeared on the tenth day and typical symptoms of the disease were not produced.

Results of Vaccine Treatment

The majority of the birds treated were owned by people in the immediate neighborhood of Columbus. They would invariably send to the hospital to be treated a few of the most severe cases and as the results were satisfactory permission was obtained to treat the entire flocks. The birds (severe cases) treated at the hospital were given extra attention (local surgical and antiseptic treatment), while those treated on the owners' premises received only the usual care from the owner following the treatment. With one exception all flocks were given but one treatment, a few birds with severe cases, amounting to approximately .5%, were sent to the hospital for a further treatment. The exact mortality rate can not be given, except in the University flock, as the owner would state satisfactory results even if a few of the most severe cases had died.

This list shows a complete record as taken from our Clinic book of all cases treated from 1910 to 1916, a period of six years.

1910-1911

Five cases treated at the clinic. These were the first cases given vaccine treatment.

Results: Three recovered.

1911-1912

Flock No. 1, 168 birds; owner, Mr. M. Joyce, Columbus, Ohio.

Results: Owner reported rapid improvement and stated: "It improves their appetite."

Flock No. 2, 69 birds; owner, Mr. C. F. Frazey, Columbus, Ohio.

Results: Good. A few required second treatment. Apparently healthy in three weeks after being treated.

Flock No. 3, 75 birds; owner, Mr. W. F. Sherman.

Results: These birds had been "out of condition" for some time and not laying. Only a few cases showed lesions. They showed rapid improvement and as many as usual were laying in January, five weeks after treatment. A neighbor's flock in a similar condition not treated remained in bad condition and were destroyed later in the winter.

Flock No. 4, 51 birds; owner, Mr. F. Hendershott, Columbus, Ohio. Condition similar to No. 3.

Results: Same. Three birds died soon after treatment.

Flock No. 5., 79 birds; owner, Mr. Chas. Aubert, Columbus, Ohio. Several showed acute symptoms.

Results: Very good. A few were given a second treatment.

Flock No. 6, 90 birds; owner, Mr. W. E. Bovey, Columbus, Ohio.

Results: Owner reported complete recovery and return to laying.

Flock No. 7, 18 birds; owned by Ohio State University, Columbus.

Results: Only advanced cases were treated. Three deaths reported.

Flock No. 8, 11 birds; owner, Mr. Frank Shank, Columbus, Ohio.

Results: Owner stated condition of birds very good.

Flock No. 9, 13 birds; owner, Mr. C. F. Frazey, Columbus.

Results: Owner was so well pleased with results of flock No. 2 that he had these treated with the same good results. No appearance of the disease during the winter.

Clinic cases: Eighteen birds brought to the clinic during the year 1911-1912 showing acute symptoms. Four of these died.

1912-1913

Flock No. 1, 45 birds; owner, Mr. J. C. Sullivan, Columbus, Ohio.

Results: Satisfactory.

Flock No. 2, 10 birds; owner, State School for Deaf and Dumb, Columbus, Ohio.

Results. Good. All recovered.

Flock No. 3, 11 birds; owner, Mr. C. W. Kigle, Columbus, Ohio.

Results: Very good.

Flock No. 4, 90 birds; owner, Mr. M. D. Steinhauer, Columbus, Ohio.

Results: "More than pleased," owner stated.

Flock No. 5, 457 birds; owner, Ohio State University, Columbus.

Results: Very good. A few were given a second treatment and five died from the disease during the winter.

Flock No. 6, 101 birds; owner, same as No. 5, 1911-1912.

Results: A few birds showed early symptoms and the entire flock was treated. The disease disappeared entirely.

Flock No. 7, 71 birds; owner, Mr. Minnick, Columbus, Ohio.

Results: A few birds showed lesions following their return from the poultry show. Disappearance of disease in three weeks after treatment.

Flock No. 8, 34 birds; owner, Mrs. Roper, Columbus, Ohio.

Results: Very good.

Flock No. 9, 46 birds; same as No. 2 this year.

Results: Complete recovery of the ten birds of No. 2 flock treated earlier induced the superintendent of the school to have these treated. Good results were obtained.

Flock No. 10, 31 birds; owner, Mrs. Stevens, Columbus, Ohio.

Results: Good.

Clinic cases: 56 birds were presented at the Clinic by 19 different owners. A few were sent in from flocks treated to be given a second treatment. Six of the 56 died and the others were discharged in good condition.

1913-1914

Flock No. 1, 120 birds; owner, Dr. Richardson, Huntsville, Ohio.

Results: Owner's statement, "highly satisfactory."

Flock No. 2, 14 birds; owner, Mr. E. J. Griffith, Columbus, Ohio.

Results: Satisfactory.

Flock No. 3, 12 birds; owner, Mr. J. H. McCoy, Columbus, Ohio.

Results: Owner well pleased.

Flock No. 4, 36 birds; owned by Ohio State University, Columbus.

Results: The disease made its appearance in one pen and was treated, checking the disease with a loss of three birds.

Flock No. 5, 63 birds; owned by State School for Deaf and Dumb, Columbus.

Results: Superintendent had flock treated to immunize them, influenced by the good results of previous years.

Flock No. 6, 112 birds; owned by Ohio State University, Columbus.

Results: Treated as prophylactic measure following the appearance of the disease in flock No. 4 of this year. No cases developed during the remainder of the year.

Flock No. 7, 40 birds; owner, Newton McClurg, Columbus, Ohio.

Results: Very good.

Flock No. 8, 25 birds; owner, Mr. P. C. Dierdorf, Columbus, Ohio.

Results: Satisfactory.

Flock No. 9, 48 birds; owner, Mrs. H. S. McBee, Columbus, Ohio.

Results: Satisfactory. Stating that her "valuable Anconas were saved" by this treatment.

Flock No. 10, 78 birds; owner, Mr. H. Kemp, Columbus, Ohio.

Results: Satisfactory.

Flock No. 11, 53 birds; owner, Mr. J. H. Greer, Columbus, Ohio.

Results: Checked the outbreak. A few cases were brought to the clinic for further treatment.

Flock No. 12, 55 birds; owner, Mr. A. W. Bixby, Columbus, Ohio.

Results: Good.

Flock No. 13, 40 birds; owner, Mr. W. A. Dumond, Columbus, Ohio.

Results: Very good. Owner asked that arrangements be made to immunize them each year.

Clinic cases: 96 birds were presented to the Clinic for treatment; 32 of these had received treatment in the above flocks, but a second injection was thought necessary. Of the 96 advanced cases treated 16 of them died and the others were discharged in good condition.

1914-1915

Flock No. 1, 60 birds; owned by the Ohio Experiment Station, Wooster, O.

Results: Very much pleased with the treatment.

Flock No. 2, 20 birds; owner, Glenella Poultry Farm, Linden, Ohio.

Results: These were all advanced cases from a large flock. Three died.

Flock No. 3, 504 birds; owner —.

Results: Unfavorable; 60% of the healthy birds contracted the disease about 15 days after being treated. Examination of the vaccine showed it had not been attenuated sufficiently.

Flock No. 4, 86 birds; owner, Mr. Charles Aubert, Columbus, Ohio.

Results: Owner stated that it "improved the appetite and general condition of the entire flock."

Flock No. 5, 66 birds; owner, Mr. J. H. Greer, Columbus, Ohio.

Results: Some of these showed severe acute cases, the majority of them improved rapidly (see flock No. 7).

Flock No. 6, 39 birds; owner, Mr. C. L. Carlisle, Columbus, Ohio.

Results: Very satisfactory.

Flock No. 7, 15 birds; owner, Mr. J. H. Greer, Columbus, Ohio.

Results: These were the most severe cases of flock No. 5 and were given another treatment.

Flock No. 8, 316 birds; owned by the Ohio State University, Columbus.

Results: The entire flock was treated. Some of the birds showed symptoms of the disease and a few of these were given second treatment (see flock No. 14).

Flock No. 9, 55 birds; owner, Mr. M. L. Myers, Marysville, Ohio.

Results: Good. Mr. Myers obtained the vaccine and administered it himself with good results and felt justified in continuing its use.

Flock No. 10, 18 birds; owner, Glenella Poultry Farm, Linden, Ohio.

Results: Good. These birds represent new cases developing since treatment of flock No. 2.

Flock No. 11, 39 birds; owner, Mr. Scothorn, Columbus, O.

Results: As no report was received the results were considered satisfactory.

Flock No. 12, 71 birds; owner, Dr. E. G. Horton, Columbus, Ohio.

Results: Good. A few cases developing a few weeks later were brought to the hospital for further treatment.

Flock No. 13, 137 birds; owner, Mr. W. H. George, Columbus, Ohio.

Results: Well satisfied with the treatment.

Flock No. 14, 20 birds; owned by the Ohio State University, Columbus.

Results: These were given second treatment (see flock No. 8). Three died.

Flock No. 15, 13 birds; owner, Glenella Poultry Farm, Linden, Ohio.

Results: These were new cases developing after treatment of flock No. 10. Owner reports good results.

Flock No. 16, 20 birds; owner, Mr. J. M. Blue, Columbus, O.

Results: Satisfactory.

Clinic cases: 48 advanced cases were presented to the Clinic for treatment and of these but 4 died.

1915-1916

Flock No. 1, 43 birds; owner, Carrie Kissel, Columbus, Ohio.
Results: Good.

Flock No. 2, 49 birds; owner Mr. J. H. Greer, Columbus, O.

Results: Severe outbreak. Seven brought to the hospital for further treatment. Three of these died.

Flock No. 3, 24 birds; owner, Mr. Charles Dozer, Columbus, Ohio.

Results: Disease was checked in the flock, and one bird brought to the hospital for further treatment. Death resulted.

Flock No. 4, 160 birds; owner, Gensemer Bros., Creston, Ohio.

Results: No report received as yet.

Flock No. 5, 1,053 birds; owner, Glenella Poultry Farm, Linden, Ohio.

Results: Owing to the unsatisfactory method of treating only the sick birds as done last year, the owner decided to have the entire flock vaccinated. About 75 birds showed symptoms of the disease at the time of treatment and 26 of these were brought to the hospital for further treatment.

Flock No. 6, 62 birds; owner, Mr. M. L. Myers, Marysville, O.

Results: "You ask my experience in regard to the use of the vaccine. I will say that thus far, and I have used it for four or five years, that at this season of the year I would not be without it. It has made the breeding of fancy birds a pleasure to me, for before its use, as a rule, I would lose at this season of the year several of my best young birds, but I have lost none since, and I have tried it on some very bad cases.

"Before the use of the vaccine, the trouble that I would have had was with the young birds that had farm or free range. While at large they appeared to be in fine condition, but as soon as confined a few days in winter quarters, then my trouble began, colds, roup, etc., which would affect the whole flock. Two years ago I treated every bird the day it was put into winter quarters, and I had but one sick bird. Last fall as I housed my birds I treated only the best ones, and the culls of the flock put in other quarters. I had no trouble with birds treated, but did with the others.

"Last winter and the winter before I treated my exhibition birds, and not one of them at the end of the season had a cold or a sign of roup, while in previous years I lost the use of some of my best birds for mating, owing to colds and roup contracted in the show room."

Flock No. 7, 54 birds; owner, Mr. J. H. Greer, Columbus, O.

Results: Second treatment was given (see flock No. 2), as a few chronic cases remained.

Flock No. 8, 29 birds; owner, Mrs. A. E. Reese, Columbus, Ohio.

Results: No report.

Flock No. 9, 21 birds; owner, Mr. F. Wilson, Columbus, Ohio.

Results: Owner reports birds in fine condition. Three acute cases were found at time of treatment.

Flock No. 10, 462 birds; owned by the Ohio State University, Columbus.

Results: Superintendent reports one death. Others in good condition. Three cases were noticed at the time they were treated.

Flock No. 11, 48 birds; owner, Mr. C. L. Carlisle, Columbus, Ohio.

Results: Good results following treatment last year induced the owner to have them immunized.

Flock No. 12, 23 birds; owner, Mr. C. H. Davies, Columbus, Ohio.

Results: No report.

Flock No. 13, 162 birds; owner State School for Deaf and Dumb, Columbus, Ohio.

Results: Too recent for report.

Clinic cases: Up to January first of this year 52 birds in advanced stages of the disease were presented at the Clinic; seven of these died.

During the past six years (1910-16) vaccine was sent to the owners of approximately 12,000 birds, living in different parts of the United States and Canada. No accurate reports have been received from the majority of owners but inasmuch as they have applied for more of the vaccine we assume that the results were equally as satisfactory as with those in the above experiments.

It has not been used extensively in treating turkeys, but from the reports received from the owners of the three or four flocks of turkeys treated the results were equally as good as for chickens.

The total number of cases treated during the past six years in and near Columbus:

1910.....	5
1911.....	592
1912.....	952
1913.....	792
1914.....	1,573
*1915.....	2,242
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Grand total.....	6,156

Mortality rate in flocks treated less than 1 per cent.

Mortality rate in flocks not treated from 10-50 per cent.

*Report only to January 1, 1916.

Summary and Conclusions.

1. From the bacteriological experiments we have made and the good results obtained from vaccination, we are of the opinion that we have been dealing with one disease only. Owing to the confusion in names which have been used to designate this disease, we have concluded to give it a new name—Infectious epitheliosis of birds (*Epitheliosis infectiosa avium*). This indicates involvement of the epithelium both of the skin and mucous membranes. It was thought that inasmuch as we find so many variable forms of the disease that this name would be more appropriate than any combination of names so far suggested.

2. Our work extending over a period of six years convinces us that typical infectious epitheliosis is due to a combination of two factors: (a) A filterable virus; (b) secondary invading organisms which vary in kind but of which the so-called "*Bacillus diphtheriae columbarum*" of Loeffler, appears to be the most important.

3. The filterable virus is the necessary primary invader which lowers the bird's resistance and thus prepares the tissues for the invasion by the secondary organisms. Neither factor alone will cause the typical disease.

4. The excellent results derived from the use of a vaccine made from the secondary organisms, both in prevention and treatment, are due to controlling the secondary infections which cause the serious complications. If these are controlled infection due to the primary virus is mild and soon disappears. (There is a remote possibility that the filterable virus is contained in the vaccine. We have no evidence that this is or is not the case. The presence of the virus in the vaccine would indicate its growth with the other organisms on the cultures. This would be contrary to our present knowledge of filterable viruses. This point will be investigated.)

5. The therapeutic dose, as indicated by the large number of birds treated, is 1 cc. for the average adult bird. Younger and smaller birds receive a lesser amount.

6. The immunizing dose found most satisfactory is 1 cc.

7. No bad results have followed when larger doses have been administered.

8. Reports received to date indicate that vaccination is equally efficacious in the treatment of infectious epitheliosis in turkeys.

The Ohio State University Bulletin is published at least twenty times during the year as follows: Monthly in June, July, August, and September, and bi-weekly in October, November, December, January, February, March, April, and May.

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